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August 31, 2016

Mr. John Collins
Montana Department of Environmental Quality
PO Box 2009010
Helena, MT 59624

Re: Lake County Landfill
Response to August 10, 2016 DEQ Review Letter

Dear Mr. Collins:

This correspondence is in response to the above referenced letter regarding the extension of the corrective measures actions proposed at the County landfill. We thank you and the other Department members for meeting with us on August 25 to discuss the contents of the letter to Mr. Nelson. We appreciate your input on this matter and found the discussion very useful.

Overall, the District proposes that the development of a numerical model for the groundwater pollution be postponed until additional data are gathered. As discussed in the meeting, all parties agree that a field reconnaissance of the area downgradient of the monitoring wells is warranted. The goal would be to find the location where ground water surfaces on the north-facing slope. That investigation may help to determine the fate of groundwater and determine the potential for receptors. We understand that you are willing to assist Mark with investigating the slope for evidence of where the groundwater surfaces. Ideally, if the seep can be located and adequate water volume is present, a water sample could be taken utilizing a shovel and/or auger. We recommend that any water be sampled for the full suite of VOCs and some of the other parameters of interest like specific conductance, chloride and nitrate. The District would like to schedule this with you as soon as possible in order to provide lead time for the laboratory testing results to be obtained and to take advantage of the extremely dry conditions.

The 2010 Corrective Measures Assessment determined that the natural attenuation approach was appropriate on the basis that the landfill would reach capacity in the short term and the final cover would be installed. The DEQ determined that a five-year period after final closure was a reasonable time to evaluate the impact of the final cover installation on the groundwater quality. As you are aware, the final cover has not yet been installed, although the District is currently in the process of bidding, contracting and constructing final cover on over 11.5 acres of the waste-fill footprint (Phase 3 Closure Project). This portion of the waste footprint is located immediately above the groundwater plume and is the area of the final closure that is most likely to have a positive impact on groundwater quality.

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The District is concerned that, until the final cover is put into place, the nature of the diffusion and/or advection of VOCs and other constituents cannot be thoroughly evaluated with the appropriate confidence. The District, therefore, respectfully requests that any analysis or review of groundwater conditions be undertaken in accordance with the original Corrective Measures Assessment timing, which is five years after the completion of the final cover. That action could affect aspects of the groundwater conditions, such as recharge and infiltration through the uncovered waste mass, in a significant manner. Continued groundwater monitoring will allow the Department to gauge any changes in conditions, and will help to inform all parties as to the impact of the final cover to the groundwater conditions. We believe this approach is further justified by the fact that the water-bearing zone being monitored at the landfill is not usable as a potable water source because of the extremely limited quantity available. Also, there have been no identified downstream receptors that create a public health or environmental risk. If future groundwater sampling and analysis warrant a completion of a numerical model, the District will continue discussions with the DEQ as to the appropriate approach.

The District further requests that the previously-submitted Master Plan update for the continued use of the facility for Class IV waste disposal be approved by the Department so the District can continue landfilling operations.

If you have questions or require additional information, please do not hesitate to contact us.

Sincerely,
Great West Engineering, Inc.

Robert Church, PE
Principal

cc: Mark Nelson, Lake County Solid Waste Manager

LAKE COUNTY

Class IV Expansion

Corrective Measures Amendment

July 2016

Prepared by:

Great West engineering ®

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Dept. of Enviro. Quality
Waste & Underground
Tank Management Bureau

LAKE COUNTY LANDFILL

Class IV Expansion

Corrective Measures Amendment

July 2016

Prepared for:
Lake County

GreatWest engineering ®

Contents

I. Introduction

The Lake County Solid Waste District is requesting an extension for the construction of the final cover of its landfill west of Polson so that a portion of the facility can be used to accept Class IV waste for approximately ten to twelve more years. The facility waste footprint consists of 30.1 acres, of which 12.3 acres has a previously constructed prescriptive final cover consisting of six inches of topsoil, 18 inches of lacustrine silt, and an underlying intermediate cover that may vary in thickness.

The District is proposing to immediately complete the final cover on 11.5 acres on the southern portion of the landfill, using the alternative cover design approved in 2009. This is termed the Phase 3 closure project. They are also proposing to remove 5.3 acres of previously constructed final cover in phases to accommodate additional Class IV waste placement until a point where the design limits are met. At that point, which is anticipated to be approximately ten to twelve years, the final cover will be completed on the remainder of the facility. The attached Class IV expansion plans detail the location The Phase 3 closure area and the area in which existing final cover will be removed.

The District has retained Great West Engineering, Inc. (GWE) to evaluate the impacts to groundwater of the proposed design changes relative to the recommendations in the District's 2010 Corrective Measures Assessment (CMA). The Montana Department of Environmental Quality (DEQ) approved a preferred alternative during that CMA process that involved no action until the Class IV waste limits were reached (Alternative A), followed by the construction of the approved final cover (Alternative B). The CMA process approved by the DEQ included the stipulation that the groundwater would be monitored on a semiannual basis for five years after the closure, and that the groundwater chemistry would be evaluated at that time to determine the effectiveness of the remediation.

The CMA (Hydrometrics, Inc., 2010) estimated that the facility would remain open for the placement of Class IV waste for approximately two years. The landfill life has lasted longer than originally anticipated and the continued need for a Class IV repository area has prompted the District to explore the potential impacts of amending the CMA. The requested amendment would include the elements noted below:

- Immediate closure of 11.5 acres on the south side of the fill area (Phase 3)
- Continued placement of Class IV waste on top of the fill area
- Phased removal of a portion of the old prescriptive cover in a strip along the northern side of the existing closure to accommodate expansion of the landfill capacity

The immediate result would be the construction of the final cover over 40 percent of the facility (Phase 3 Closure). Including the phased removal of 5.3 acres of the old cover, approximately 60 percent of the landfill will have final cover (11.5 acres Phase 3 Closure + 12.3 acres prescriptive cover – 5.3 acres prescriptive cap removal = 18.5 acres closed short term). The remaining 11.7 acres would be closed when the landfill reaches capacity in ten to twelve years.

II. Groundwater Quality History

In order to determine the potential impacts of the proposed amendment to groundwater at the facility, we conducted a review of the history of the facility, the existing conditions, and changes in groundwater chemistry since the CMA was proposed.

The County completed the final cover on approximately one-third of the landfill (12.3 acres) in the mid 1990s. The remainder of the Class II area has remained with only intermediate cover in place since that time. Since about 2003 a number of changes have occurred in the groundwater chemistry. The historical groundwater chemistry data reveals variable trends that may or may not be interrelated.

For example, nitrate levels fell rather dramatically, from double-digits in two of the down-gradient wells in June, 2006 to less than five mg/L in 2015, and sulfate levels fell 50 percent in well L-11 during that same period. Conversely, the concentrations of a number of other analytes rose dramatically. Those analytes include specific conductance, chloride, benzene, chloroethane, cis-1,2-dichloroethene, methylene chloride, tetrachloroethene, trichloroethene, vinyl chloride and xylenes. Most of the increases in concentration do not exceed Montana water quality standards, with the exception of methylene chloride.

The Corrective Measures Assessment (Hydrometrics, Inc., 2010) describes the groundwater chemistry and delineates certain trends, but we note from subsequent groundwater monitoring reports that some significant changes have occurred since that time (Hydrometrics, Inc., 2015).

A. Specific Conductance and Chloride

Two aspects of groundwater chemistry that are considered indicators of groundwater contamination by landfill leachate are specific conductance and chloride. Both of those analytes have increased in concentration by 20 to 200 percent since 2009. Chloride rose in well L-11 from about 10 milligrams per liter (mg/L) to about 35 mg/L between 1993 and 2009. Specific conductance at well L-11 rose from about 400 to 600 micromhos per centimeter during that same period. The most significant increase in chloride has occurred in well L-10, from the low single digits in the 1990s to over 140 mg/L in 2015.

B. Sulfate

The history of sulfate in groundwater at the Lake County landfill does not exhibit any clear-cut long-term trends. It has been decreasing in concentration in well L-11 since the early 2000s, but has remained largely consistent in the background well, L-7, and the other downgradient well, L-10. Sulfate does not have a human health standard limit.

C. Nitrate

The aquifer being monitored at the landfill has contained nitrate concentrations from 2.6 to about 18 mg/L. The property south of the landfill west of the access from Kerr Dam Road was, prior the 1999 landfill expansion exploration project, farmed for dryland grain. The aquifers lie at relatively shallow depths, relative to the original land surface, with the top of the water table generally being at a depth of only a few tens of feet. Nitrate at LE-124, a monitoring well within that southern perched aquifer, was measured at 53 mg/L in 1999. That well is in the center of another perched aquifer that lies to the south of the monitored landfill. The very high nitrate in the expansion area wells very likely originated with fertilizers used on that property. The southern edge of the landfill aquifer extends beneath that property, so one could make a reasonable assumption that at least some of the nitrate enrichment originates with agricultural fertilizers. As the fertilizer-related nitrate infiltrated the locally-recharged aquifer, the source likely became depleted, thereby contributing progressively less and less nitrate to the landfill aquifer.

Nitrate concentrations have declined 1,600 to 1,700 percent since 2009. The cause of that decline in not entirely clear, but is suspected to be predominately the result of a depletion of a nitrate source in the adjoining property.

Nitrate has a human health standard of 10 mg/L.

D. Acetone

Acetone first appeared in groundwater samples in 2009. Concentrations of that volatile organic compound (VOC) have since occurred at levels from about 20 micrograms per liter (u/L) to over 150 ug/L. The rather sudden appearance of high concentrations of acetone is puzzling, since Class II waste, which is the most likely source for acetone, has not been added to the waste pile in some 15 years. A container or containers may have released acetone within the waste pile and the chemical may have migrated to groundwater. Acetone does not adsorb readily to soils and is miscible in water, so the acetone may originate as a liquid infiltrating the waste and underlying soil, and dissolving in groundwater. However, the acetone may originate from a number of sources, included degraded MTBE.

Acetone has no federal or Montana State health-based standard for drinking water.

E. Benzene

Benzene first appeared in groundwater samples at well L-11 in 2007. A sample from well L-8 produced an analysis of benzene in 2009, but that well hadn't been sample for many years previously, so the initial migration of benzene to that well is unknown. Benzene appeared in samples from well L-10 in 2010. Benzene is generally associated with petroleum products, so its source within the waste mass is not obvious.

The water quality standard limit for benzene in Montana is 5 ug/L.

F. Chloroethane

Chloroethane first occurred in groundwater in 2010 in wells L-8, -10 and -11. That VOC was not detected in any samples in 2012 and early 2013, but then reappeared in late 2013. Given the presence of 1,1,1-trichloroethane in groundwater over the monitoring history, chloroethane may be present as a result of dehalogenation.

Chloroethane has no federal or Montana State health-based standard for drinking water.

G. Dichlorodifluoromethane

A refrigerant commonly found in the soil gas and groundwater at unlined landfills. Its concentrations in groundwater have varied since 1993, but has been present in all but one sample taken from well L-11. This VOC may be an indicator of vapor-phase migration of any number of other chemicals from the waste mass into the vadose zone and groundwater.

The water quality standard limit for dichlorodifluoromethane in Montana is 1,000 ug/L.

H. 1,1-Dichloroethane

Possibly a degradation product of 1,1,1-TCA, 1,1-DCA first appeared in groundwater in 2000. It is now found in groundwater at three down-gradient wells, with the highest concentrations found at well L-11 (2 to 2.5 ug/L).

Montana DEQ Circular DEQ-7 does not list 1,1-dichloroethane in its listing of standards.

I. Cis-1,2-Dichloroethene

Initially occurring in samples from well L-11 in 2004, cis-1,2-dichloroethene is now found in three down-gradient wells. Concentrations in groundwater have exceeded five ug/L in well L-8, and appear to be increasing steadily in well L-11.

The Montana drinking water standard for cis-1,2-dichloroethene is 70 ug/L.

J. Methylene Chloride

Methylene chloride was first detected in groundwater at the facility in well L-11 in 2000. While concentrations were somewhat variable over time, and below the human heath standard of 5 ug/L, they began to increase markedly after 2007. The chemical has been found in samples from well L-11 in concentrations from 10 to 15 ug/L since 2009. It has also been consistently detected in samples from wells L-8 and L-10 since at least 2012, with reported values all below 5 ug/L. Methylene chloride is the only analyte exceeding a human health standard at the facility.

The human health standard for methylene chloride is 5 ug/L.

K. MEK and MIBK

These first appeared in groundwater at the facility in 2012 and 2013. The reported MEK values have exceeded 200 ug/L and MIBK values have exceeded six ug/L. They have only been reported from well L-8. MIBK has a lower miscibility, but both appear to be readily transported by water or in the vapor phase.

There is currently no human health standard for MEK or MIBK regarding drinking water or groundwater.

L. Tetrachloroethene

PCE first appeared in a samples from well L-11 in 1995. Concentrations in subsequent samples steadily increased until 1999, decreased through 2004, and rose again starting in 2005. Most recently, concentrations at that well have been roughly around 2.5 ug/L. concentrations never exceeded 2.8 ug/L. PCE has been detected at the other two down-gradient wells sporadically since 2009.

The Montana human health standard for PCE is 5 ug/L in groundwater and drinking water.

M. 1,1,1-Trichloroethane

1,1,1-trichloroethane has only occurred at well L-7, but has been found consistently at concentrations generally below 1 ug/L.

The Montana human health standard for 1,1,1-trichloroethane is 5 ug/L in groundwater and drinking water.

N. Trichloroethene

While analyses report TCE to be less than 1 ug/L in all samples, it did not appear until late 2006. TCE has consistently appeared in samples from all three down-gradient wells since 2014. It is possibly a degradation product of PCE.

The Montana human health standard for trichloroethene is 5 ug/L in groundwater and drinking water.

O. Vinyl Chloride

Vinyl chloride was first detected in well L-11 in 2011. Samples taken in 2013 revealed its presence in the groundwater at three down-gradient wells, although it has only consistently increased at well L-8. The most-recent sample from that well contained 1.4 ug/L VC.

The human health standard for vinyl chloride is 5 ug/L for groundwater and drinking water in Montana.

P. Xylenes

Xylenes began to be detected in groundwater at well L-11 in 2011 and have since been found at all three down-gradient sampling sites. While concentrations in groundwater have generally been less than 0.5 ug/L, a sample from well L-8 taken in 2014 contained 3 ug/L.

The various xylenes have a drinking water and groundwater standard of 1×10^4 ug/L.

III. Discussion of Groundwater Trends

The Corrective Measures Assessment completed by Hydrometrics, Inc. (2010) determined that a period of "no action" (Alternative A) followed by the completion of the final cover on the facility and observing it for a period of five years (Alternative B) was the preferred approach. The basis for that selection is cited as the final cover acting to reduce infiltration and, consequently, the production of landfill leachate. The methylene chloride, which at the time was the major chemical of concern, appears to be considered by Hydrometrics, Inc. (2010) to be contained within landfill leachate.

Since 2010, however, a number of trends have developed in the groundwater chemistry. Specific conductance and chloride concentrations have been increasing fairly significantly, with values reported for 2015 being as much as three times higher than those reported in 2010. Acetone has made a relatively sudden appearance, and benzene and some other chlorinated hydrocarbons have been increasing somewhat. At the same time, nitrate concentrations have fallen significantly. These trends are examined below in the context of the potential transport mechanisms, which are limited to the either the infiltration of landfill leachate to groundwater or the diffusion of gaseous-phase chemicals across the top of the water table.

A. Leachate

The possibility exists that the increasing chlorides in the aquifer may be due, at least in part, from the dechlorination of certain VOCs. The degradation of chlorinated solvents involves the removal of ^{-}Cl, which will bond with an electron acceptor and create a situation in which additional chlorides develop in the groundwater. However, an increase in chloride concentrations from less than 10 mg/L to nearly 150 mg/L over a period of six years, as observed at well L-10, do not appear to be the result solely of the dechlorination of solvents. While we have not attempted to calculate the mass balance of the system, a simple comparison of the molar availability of chloride ions from VOCs, which total in the tens of micrograms per liter, to chloride values measured well over 100 milligrams per liter does not favor the hypothesis.

The increase in specific conductance, similarly, is probably not solely due to methanogenesis or other decay process of VOCs. While there may be some contribution resulting from potential changes in oxidation-reduction conditions, attributing an increase from a few hundred micromhos per centimeter (umho/cm) to nearly 2,000 umho/cm to VOC degradation by any means does not seem reasonable.

Finally, TCA and PCE generally do not degrade via aerobic biodegradation. Given that the aquifer is relatively shallow (less than 40 feet below the ground surface), the groundwater is more likely to be oxygen-rich than oxygen-depleted.

The presence of increasing values of indicator parameters, with the exception of nitrate, points toward the infiltration of leachate into groundwater. Supporting that contention is the appearance of VOCs that are miscible in and/or readily transported by water. Also, the increasing frequency of previously-undetected VOCs may well be due to increased chemical mobility resulting from increasing volumes of fluids migrating toward the uppermost aquifer. In short, the waste mass has been absorbing water for many decades, and approximately two-thirds of the waste mass still does not have a final cover in place. In addition, the portion of the facility immediately above the documented contaminated groundwater plume has not received a final cover. After that period of time, leachate is quite probably being generated in this area and is transporting contaminants directly to the groundwater.

B. Gaseous Diffusion

Gaseous diffusion of chemicals from landfill masses into groundwater is a feasible transport mechanism. We note from the 2015 groundwater monitoring report (Hydrometrics, Inc., 2015) that dichlorodifluoromethane (DCDFM) and trichlorofluoromethane (TCFM) have been consistently detected at low concentrations in groundwater for over 20 years. In reviewing the physical characteristics of those refrigerants, we note that they have relatively high vapor pressures and low boiling points. The probability of such chemicals to move through a waste pile as liquids is low. They can be carried by leachate migrating through the waste as dissolved constituents, however they are more likely to migrate in a gaseous state. The fact that DCDFM and TCFM concentrations in groundwater have remained constant or have declined over the past five to ten years leads us to conclude that they are entering the saturated zone primarily via gaseous diffusion.

C. Transport Mechanism Conclusions

The apparently-conflicting water chemistry trends create a challenge to assessing the processes affecting the existing groundwater conditions. While there are clearly indications that anaerobic dechlorination is occurring, there are also indications that other processes may be affecting the groundwater chemistry simultaneously.

The chemical evidence leads us to the concur with the conclusions of the 2010 CMA and subsequent groundwater monitoring reports that leachate is migrating from the waste into the shallow aquifer, bringing with it increased dissolved solids, chlorides and VOCs. At the same time, the leachate infiltration appears to be enhancing the dechlorination process due to its inherent anaerobic character. At the same time, other constituents appear to be entering groundwater not through leachate migration, but as a result of gaseous diffusion from the waste across the top of the water table. These elements of the process are discussed in the following section.

IV. Contamination Source, Transport and Fate

A. Source and Transport

As noted in the previous section, VOC contamination can occur as either leakage of liquid-phase contaminants into groundwater, dispersion as a dissolved fraction of leachate, or via diffusion in the gaseous phase. Great West suspects that at least two of those three mechanisms are occurring at the Lake County landfill.

We consider the likelihood of widespread mass releases of VOCs in liquid form within the waste mass to be remote. However, relatively sudden appearances of some VOCs, such as high concentrations of acetone, may well represent the sporadic release of the contents of previously-sealed containers that have corroded and failed. The increased concentrations of certain indicator parameters point toward the landfill leachate migrating vertically downward, entering the groundwater either directly from the waste mass or by migrating across the top of the lacustrine silt to the perched water table aquifer.

Persistent low-level VOCs in groundwater involve vapor-phase chemicals permeating the waste mass and entering groundwater across the top of the water table via diffusion. While no empirical evidence for the migration of VOCs in the vapor phase has been presented previously, our experience at other unlined facilities leads us to the conclusion that this is the most likely pathway for at least some specific VOCs to groundwater.

B. Fate of Contaminants

The fate of groundwater contaminants is discussed in the facility's CMA (Hydrometrics, Inc., 2010) on pages 2-3 through 2-6. The discussion in that document is not repeated here, except to say that the summary concludes that sufficient evidence exists to conclude that the ultimate fate of the chemical of concern and, most probably, other groundwater constituents does not pose a risk to human health and poses a minimal risk to the natural environment. Great West agrees with the conclusions that groundwater contamination at this facility presents minimal to no risks to human health and the environment.

V. Proposed Class IV Expansion Effects

The proposed extension for the acceptance of Class IV waste at the Lake County landfill will result in the immediate closure of the southern portion of the landfill (approximately 11.5 acres) and the removal of a portion of the old prescribed cover (approximately 5.3 acres). The area where the old cover is to be removed will be filled with Class IV waste to a point where the existing grades at the base form an appropriately-graded slope.

A. Existing Conditions

Approximately 12.3 acres of the landfill is currently closed with a cover that consists of six inches of topsoil underlain by 18 inches of lacustrine silt. The cover was installed atop a 12- to 18-inch layer of sand and gravel intermediate cover. The remaining portion of the landfill has a layer of intermediate cover. The various covers lie atop municipal solid waste ranging in thickness from 65 to 85 feet or more.

Groundwater underlies a portion of the waste fill area and over the past 25 years various indicator parameters and volatile organic compounds have occurred in anomalously-high concentrations. The County and the Montana Department of Environmental Quality have determined via an assessment of corrective measures that natural attenuation of contaminants and the ultimate closure of the landfill is an appropriate approach for the groundwater remediation. Currently, the only chemical constituent in the groundwater that exceeds any human health standard is methylene chloride (dichloromethane).

Certain groundwater constituents have developed increasing or decreasing trends. As inferred above, the reasons for those trends are not entirely obvious, but the existing data lead us to the conclusion that both vapor-phase and liquid-phase migration of contaminants are at play.

B. Proposed Conditions

The County will proceed with the final closure of the 11.5 acres as designed under Phase 3. Approximately 5.3 acres of the currently-closed area will have the cover removed in phases and Class IV waste will be placed in those areas until the final contours are attained. The removal of the cover will be phased, starting with approximately one acre on the western end of the closed area.

C. Impacts of Infiltration through the Final Cover

The final closure of an additional 11.5 acres of the landfill will significantly reduce the potential for precipitation to infiltrate the waste mass and migrate into the perched aquifer underlying and proximal to the facility. That contention is supported by the work completed by Benson and others (2002) and Albright and Benson (2005) in their reporting of the evaluation of the final cover performances of two test pads constructed at the Lake County landfill. They noted that the average annual infiltration through the proposed alternative cover system, after almost five years in place, was 0.12 inches during a period with an average precipitation rate of over 15 inches annually. For comparison, a test pad employing a flexible-membrane liner allowed 0.46 inches of moisture through during the same period. Modeling presented by Great West Engineering, Inc. (2007) predicted that sand typical to the facility would transmit 0.83 inches of water through a monofill cover under high-precipitation conditions.

Great West attempted to develop at least a semi-quantitative evaluation of the effects of completing the landfill final cover and removing the 5.3 acres of existing cover. We attempted to utilize HELP model to determine if the changes in the cover configurations could aid in predicting any significant changes in groundwater chemistry. However, we could not satisfactorily match the observed test pad results with the computer simulations. Only by manipulating the soil characteristics could the HELP model reflect the results observed in the test pads. We note that the HELP models, when measured soil characteristics were used, generated at least several inches of leachate annually over a 30-year period. Give the known dimensions and properties of the perched aquifer proximal to the facility, those predictions conflict with the very low measurable flow through the saturated zone. We did not feel that the model results accurately informed the investigation, so the results are not included herein.

The proposed action will not likely reduce leachate migration initially. Moisture within the waste mass will likely continue to migrate until the infiltration source is reduced. The volume of fluid reaching the saturated zone will eventually diminish, which will reduce recharge to the groundwater. Because the saturated zone partially underlies the portion of the waste mass that would be capped (Phase 3), the amount of leachate migrating directly to the groundwater would be reduced significantly after a period of time.

We note that large areas of the waste mass overlie unsaturated portions of the aquitard. Those areas may well be producing leachate, but if so, the leachate would have to migrate atop the paleosurface represented by the top of the lacustrine silt bed aquitard prior to reaching the saturated zone.

Another important element of the proposed action involves the removal of 5.3 acres of final cover. We are admittedly unsure of the role the existing cover plays in the prevention of infiltration into the waste mass. We do know, however, that the existing final cover is not as protective as the proposed final cover, and that the slope on this portion of the existing final cover is minimal. We have anecdotal evidence that water pools on portions of the existing final cover that are proposed for removal. Without a grade appropriate for providing maximum runoff, there is a very high likelihood that the final cover in that area is not functioning as well as designed. Removal of the final cover in that area will result in a minimal short term increase in infiltration however the better final cover design with an appropriate grade will result in an overall long term decrease in infiltration.

D. Impacts of Vapor Migration

Great West initially had concerns about the potential for trapping volatile organic compounds under the cap. However, the cap will be vented, and since the facility is unlined a good percentage of landfill gases can escape laterally to the atmosphere. The removal of a portion of the old cover for the expansion of the Class IV area will allow some further release of landfill gases. Covering the landfill would not affect the transport processes that are currently impacting groundwater, and it may be that the impacts may have been somewhat mitigated by not having a final cover for the past few years.

Great West also attempted to develop a semi-quantitative evaluation of the soil gas using the POLLUTE model. However, the model was not appropriate for this application since it doesn't allow for two-way migration of gaseous chemicals. That is, the model assumes that the landfill is capped and will not allow for a percentage of release to the atmosphere. It only allows a fixed mass or constant mass as a source for modeling gas migration. The results of the test models are not included herein.

E. Contaminant Fate of Proposed Action

The fate of the various groundwater constituents will not change as a result of the proposed action.

VI. Conclusions

The proposed changes in cover configuration at the Lake County landfill will not appear to have a significant impact on the processes currently affecting the source, fate or transport of VOCs and other chemical constituents of the perched saturated zone proximal to and partially underlying the facility. The absence of a final cover over 17.8 acres of the facility immediately above the contaminant plume in the uppermost aquifer has undoubtedly allowed a portion of precipitation to infiltrate the waste, but has also allowed a somewhat higher rate of off-gassing of VOCs and other landfill gases. Implementation of the 11.5 acre Phase 3 Closure project will significantly reduce long term infiltration in the area immediately above the groundwater plume. The existing closed portion, which accounts for 12.3 acres, is not performing to the level of the proposed alternative cover, particularly over the area proposed for removal.

We conclude that covering the as-yet uncovered area will reduce the infiltration, although some additional leachate continue to be generated in the future as the moisture migrates downward. The vents in the proposed system will provide for the release of landfill gases to the atmosphere. The phased removal of a portion of the existing cover will allow for some additional infiltration into the waste, but the existing cover is not as effective as the proven alternative design which will eventually be installed. The area proposed for the additional Class IV waste is also relatively flat, and is not providing optimal runoff potential. When completed, that 5.3-acre area will have a more effective final cover and a steeper grade than it currently does, which will result in a further-reduced infiltration. Comparing the existing conditions with the proposed conditions, GWE cannot identify any elements that would adversely affect the accepted natural attenuation process. Some elements of the plan would reduce the potential for leachate production and ultimately lead to a higher level of performance than provided by the existing cover within the proposed Class IV use area.

VII. References

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